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LANDSAT 8 (L8)
LEVEL 1 (L1)
DATA FORMAT CONTROL BOOK (DFCB)

Version 9.0

May 2015

USGS
science for a changing world

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LEVEL 1 (L1)
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May 2015

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Executive Summary

This Data Format Control Book (DFCB) presents detailed data formats of the output files that the Landsat 8 Image Assessment System (IAS) and Level 1 Product Generation System (LPGS) generate. These Level 1 (L1) processing systems produce L1 output files from Level 0 Reformatted (L0R) images. Images are produced in the Geographic Tagged Image File Format (GeoTIFF) format.

The Landsat Operations and Maintenance (O&M) Ground Segment (GS) Configuration Control Board (CCB) maintains and controls this DFCB. Staff may update or revise this document only upon Landsat O&M GS CCB approval. Please direct comments and questions regarding this DFCB to the following:

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Section 1 Introduction

1.1 Purpose

This Data Format Control Book (DFCB) provides a high-level description of the Landsat 8 Level 1 (L1) distribution product, product packaging, and viewing tools.

1.2 Scope

This DFCB describes the formats and data contents of the L1 output files. The output format generated by the Level 1 Product Generation System (LPGS) for distribution is Geographic Tagged Image File Format (GeoTIFF).

The file formats contained in this DFCB are applicable to the products generated by L1 producing systems operated at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center.

1.3 Intended Users

This document is a guide for L1 product recipients. It provides detailed information on L1 product packaging.

1.4 Definitions

Level 1 Geometrically Corrected (L1G) digital image — Radiometrically corrected and resampled for geometric correction and registration to a geographic map projection referenced to the World Geodetic System 1984 (WGS84), G873, or current version.

L1G product — L1 product distributed by the LPGS that includes, for all requested bands and the quality band, GeoTIFF format L1G images and associated data accommodated by the format.

Level 1 Systematic Terrain (Corrected) (L1Gt) product — L1Gt Terrain Correction product that includes radiometric and geometric corrections, and uses a Digital Elevation Model (DEM) to correct parallax error due to local topographic relief; the accuracy of the terrain-corrected product depends on the resolution of the best available DEM.

Level 1 Terrain (Corrected) (L1T) product — Includes radiometric, geometric, and precision correction, and uses a DEM to correct parallax errors due to local topographic relief; the accuracy of the terrain-corrected product depends on the availability of Ground Control Points (GCPs), as well as the resolution of the best available DEM.

Section 2 Overview of Level 1 Output Files

This section provides an overview of the L1 output files.

2.1 L1Gt / L1T Output Files Overview

Standard L1T products, which are Digital Number (DN) products in an unsigned 16-bit integer format, can be converted to Top of Atmosphere (TOA) reflectance (Bands 1–9) or radiance (Bands 1–11) using scaling factors provided in the product metadata. Refer to LSDS-649 Landsat 8 (L8) Calibration and Validation (Cal/Val) Algorithm Description Document (ADD) for a description of the radiance and reflectance calculations, and rescaling procedures used during processing. Refer to LSDS-810 Landsat 8 (L8) Calibration Parameter File (CPF) Data Format Control Book (DFCB) for definitions of the reflectance conversion and the rescaling values used to process the L1 products. The Calibration Parameter File (CPF) used to process a specific scene can be accessed through the USGS Landsat Web site (http://landsat.usgs.gov/).

The L1Gt / L1T image data are radiometrically and geometrically corrected and are available in GeoTIFF. Table 2-1 shows the band identification, while Table 2-2 lists the L1Gt / LT product components.

Band Reference Number	Band Description	Band Center (nm)
1	Coastal Aerosol (Operational Land Imager (OLI))	433
2	Blue (OLI)	482
3	Green (OLI)	562
4	Red (OLI)	655
5	Near-Infrared (NIR) (OLI)	865
6	Short Wavelength Infrared (SWIR) 1 (OLI)	1610
7	SWIR 2 (OLI)	2200
8	Panchromatic (OLI)	590
9	Cirrus (OLI)	1375
10	Thermal Infrared Sensor (TIRS) 1	10800
11	TIRS 2	12000

Table 2-1. Band Reference Table

Level 1 Product Components
L1Gt / L1T image file (one for each band)
Quality Band (QB) file
Checksum file
L1Gt / L1T metadata file
Angle coefficient file

Table 2-2. File Components

2.1.1 Final Product Packaging

The final output product is a tar.gz file. The files are written to a tar file format and then compressed with the gzip application. The tar file does not contain any subdirectory

information. Therefore, uncompressing (untarring) the file extracts all of the files directly into the current directory.

2.1.2 Naming Convention

Table 2-3 and Table 2-4 contain the file names associated with the L1 products.

Ls8ppprrrYYYYDDDGGGVV_FT.ext

Identifier	Description
L	Landsat
s	Sensor of: O = OLI, T = TIRS, C = Combined TIRS and OLI Indicates which sensor collected data for this product
8	Landsat mission number
ppp	Satellite orbit location in reference to the Worldwide Reference System-2 (WRS-2) path of the product
rrr	Satellite orbit location in reference to the WRS-2 row of the product
YYYY	Acquisition year of the image
DDD	Acquisition day of year
GGG	Ground Station ID
VV	Version
_FT	File type, where FT equals one of the following: image band file number (B1–B11), MTL (metadata file), BQA (quality band file), MD5 (checksum file)
.ext	File extension, where .TIF equals GeoTIFF file extension, and .txt equals text extension

Table 2-3. File Naming Convention

Ls8ppprrrYYYYDDDGGGVV.FT.ext

Identifier	Description
L	Landsat
s	Sensor of: O = OLI, T = TIRS, C = Combined TIRS and OLI Indicates which sensor collected data for this product
8	Landsat mission number
ppp	Satellite orbit location in reference to the WRS-2 path of the product
rrr	Satellite orbit location in reference to the WRS-2 row of the product
YYYY	Acquisition year of the image
DDD	Acquisition day of year
GGG	Ground Station ID
VV	Version
.FT	File type, where FT equals tar (tarred file)
.ext	File extension, where .gz equals zipped (compressed) extension

Table 2-4. Compressed Product File Naming Convention

2.1.3 Example File Names

2.1.3.1 Image Files

LC82220052014265LGN00_B1.TIF
LC82220052014265LGN00_B2.TIF
LC82220052014265LGN00_B3.TIF
LC82220052014265LGN00_B4.TIF
LC82220052014265LGN00_B5.TIF
LC82220052014265LGN00_B6.TIF
LC82220052014265LGN00_B7.TIF
LC82220052014265LGN00_B8.TIF
LC82220052014265LGN00_B9.TIF
LC82220052014265LGN00_B10.TIF
LC82220052014265LGN00_B11.TIF

2.1.3.2 Quality Band

LC82220052014265LGN00_BQA.TIF

2.1.3.3 Metadata

LC82220052014265LGN00_MTL.txt

2.1.3.4 Angle Coefficient File

LC82220052014265LGN00_ANG.txt

2.1.3.5 Compressed

LC82220052014265LGN00.tar.gz

2.1.3.6 Checksum

LC82220052014265LGN00_MD5.txt

Section 3 Data Format Definition

This section describes the storage format for the data.

3.1 GeoTIFF

GeoTIFF defines a set of Tagged Image File Format (TIFF) tags, which describe cartographic and geodetic information associated with geographic TIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data. However, the TIFF file structure allows both the metadata and the image data to encode into the same file.

3.1.1 L1Gt / L1T Image File

The description of an image in GeoTIFF requires tags and keys; the image files contain these tags and keys, which are read by GeoTIFF readers.

Each image band in the L1Gt / L1T product is in a separate file. Each band comprises a grayscale GeoTIFF file, which is in uncompressed 16-bit unsigned integers.

3.1.1.1 GeoTIFF Tags

GeoTIFF tags convey information about the image. The tags describe the image using information the GeoTIFF reader needs to control the appearance of the image on the user's screen. The TIFF tags are embedded in the same file as the TIFF image. The GeoTIFF tags provide information on the image projection and corner points, which define the geographic location and extent of the image.

A complete description of the raster data requires geo-referencing of the data, which is accomplished using tags. The L1 production system uses the transformation raster, model space tie points, and scaling parameters. ModelTiepointTag and ModelPixelScaleTag are used for this purpose.

3.1.1.1.1 GeoTIFF ModelTiepointTag

The GeoTIFF ModelTiepointTag stores the raster-to-model tiepoint pairs.

3.1.1.1.1.1 Description

The raster-to-model tiepoint pairs are stored in the following order: ModelTiepointTag = (..., I, J, K, X, Y, Z...), where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space. The ModelTiepointTag requires that K and Z are set to zero. See the GeoTIFF Specification document (see References) for more information.

The raster image is geo-referenced by specifying its location, size, and orientation in the model coordinate space. Because the relationship between the raster space and the model space often are exact, the affine transformation relationship can be defined using

one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

3.1.1.1.1.2 Parameters

Tag = 33922
Type = DOUBLE
N = 6*K, K = number of tiepoints

3.1.1.1.2 GeoTIFF ModelPixelScaleTag Tag

The GeoTIFF ModelPixelScaleTag tag specifies the size of the raster pixel spacing in the model space units when the raster space is embedded in the model space coordinate system without rotation.

3.1.1.1.2.1 Description

The size of raster pixel spacing in the model space units consists of three values. These values are ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ), where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels, and ScaleZ maps the pixel value of a DEM into the correct Z-scale.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, determines the relationship between raster and model space.

3.1.1.1.2.2 Parameters

Tag = 33550
Type = DOUBLE
N = 3

3.1.1.2 GeoTIFF Keys

In addition to tags, the description of a projection in GeoTIFF requires the use of keys. Table 3-1 lists the keys necessary to define the projections supported by the L1 production systems, along with their possible values.

Valid Keys	Possible Values	Meaning
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	2	RasterPixelIsPoint (the coordinate is at the center of the pixel)
GTCitationGeoKey	(ASCII, 17)	American Standard Code for Information Interchange (ASCII) reference to public documentation
GeogLinearUnitsGeoKey	9001	Linear_Meter
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000–32760	European Petroleum Survey Group (EPSG) Projection System Codes
	32767	User-defined

Table 3-1. GeoTIFF Keys Used to Define UTM Projection

Valid Keys	Possible Values	Meaning
ProjCoordTransGeoKey	15	CT_PolarStereographic
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	2	RasterPixelIsPoint (the coordinate is at the center of the pixel)
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000–32760	EPSG Projection System Codes (see the EPSG Geodetic Parameter Registry for values)
	32767	User-defined
ProjectionGeoKey	10000–19999	EPSG / Petrotechnical Open Software Corporation (POSC) Projection Codes (see the EPSG Geodetic Parameter Registry for values)
	32767	User-defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
ProjStraightVertPoleLongGeoKey	0.0000000	Value in units of GeogAngularUnits
ProjNatOriginLatGeoKey	-71.0000000	Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey	0.0000000	Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey	0.0000000	Value entered in units of ProjLinearUnits

Table 3-2. GeoTIFF Keys Used to Define Polar Stereographic Projection

3.1.2 Quality Band (QB) File

The QB file contains quality statistics gathered from the image data and cloud mask information for the scene. The QB file is a 16-bit image with the same dimensions as the L1Gt or L1T scene. Bits are allocated for some artifacts that are distinguishable at the L1G stage of processing. Bit 0 is the least significant. Several land surface classification types exist and a range of confidence levels are provided for each classification type.

The two-bit confidence levels are as follows:

00 No confidence level set (used for fill or for a class not reported)
01 Low confidence
10 Mid confidence
11 High confidence

A QB value of 1 (00 01 hex) is reserved for fill data. When processing a non-fill pixel, reaching this QB value should not be possible. High-confidence clouds (values 11 in bits 14 and 15) should have a value of C000 hex or 49152.

Bit	Flag Description	Values
0	Designated Fill	0 for image data 1 for fill data
1	Dropped Frame (Reserved)	0 for image data 1 for dropped frame
2	Terrain Occlusion	0 for normal data 1 for terrain occlusion
3	Reserved	Reserved for a future 1-bit class artifact designation
4–5	Water confidence	00 = None or Unset 01 = 0–35% confidence the pixel is water 10 = 36–64% confidence the pixel is water 11 = 65–100% confidence the pixel is water
6–7	Cloud Shadow confidence (Reserved)	Same as water confidence
8–9	Vegetation confidence (Reserved)	Same as water confidence
10–11	Snow / Ice confidence	Same as water confidence
12–13	Cirrus confidence	Same as water confidence
14–15	Cloud confidence	Same as water confidence

Table 3-3. QBBit Description

3.1.3 Checksum File

A checksum file is created for every product. A checksum file is generated on the final .tar.gz file. The checksum file contains a listing of Message-Digital Algorithm 5 (MD5) checksums for all files, except for itself. The file is in plain text format and contains the system's md5sum output. For example, a collection with a scene ID of LC82220052014265LGN00 has a checksum file named LC82220052014265LGN00_MD5.txt.

3.1.4 L1 Metadata File

The L1 metadata file is created during product generation and contains information specific to the product ordered. Table 3-4 lists the full contents of the L1 metadata file. The metadata file is text in the Object Description Language (ODL) format.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= L1_METADATA_FILE	The beginning of the first-level ODL group. It indicates the start of the L1 metadata file level group.
GROUP	= METADATA_FILE_INFO	The beginning of the metadata file information group.
ORIGIN	= “Image courtesy of the U.S. Geological Survey”	Origin of the product.
REQUEST_ID	= “NNNNNNNNNNNNN_UUUUU”	Product Request ID. NNNNNNNNNNNNN_UUUUU, where NNNNNNNNNNNNN = 13-digit Tracking, Routing, and Metrics (TRAM) order number and UUUUU = 5-digit TRAM unit number.
LANDSAT_SCENE_ID	= “Ls8ppprrrYYYYDDDGGGVV”	The unique Landsat scene identifier.
FILE_DATE	= YYYY-MM-DDTHH:MM:SSZ	The date when the metadata file for the L1G product set was created. The date is based on Universal Time Coordinated (UTC) (also known as Greenwich Mean Time (GMT)).
STATION_ID	= “XXX”	The Ground Station that received the data. See LSDS-547 Landsat Ground Station (GS) Identifiers for all possible station IDs (e.g., “LGN” = Landsat Ground Network) (see References).
PROCESSING_SOFTWARE_VERSION	= “IAS_X.Y.Z” = “LPGS_X.Y.Z”	The processing software version that created the product. The version consists of a system name followed by an underscore and then the software version, where X is the major release number, Y is the minor release number, and Z is the patch (or engineering) release number. X, Y, and Z are all numeric values.
END_GROUP	= METADATA_FILE_INFO	The end of the metadata information group.
GROUP	= PRODUCT_METADATA	The beginning of the product metadata group.
DATA_TYPE	= “L1T” = “L1GT”	The identifier to inform the user of the product type.
ELEVATION_SOURCE	= “GLS2000” = “RAMP” = “GTOPO30”	Indicates the source of the DEM used in the correction process.
OUTPUT_FORMAT	= “GEOTIFF”	The output format of the image.
SPACECRAFT_ID	= “LANDSAT_8”	Spacecraft from which the data were captured.
SENSOR_ID	= “OLI_TIRS” = “OLI” = “TIRS”	Sensor(s) used to capture this scene.
WRS_PATH	= 1-251	Orbital WRS-2 defined nominal Landsat satellite track (path).
WRS_ROW	= 1-248	Orbital WRS-2 defined nominal Landsat row number for this scene.
NADIR_OFFNADIR	= “NADIR” = “OFFNADIR”	Nadir or Off-Nadir condition of the scene.
TARGET_WRS_PATH	= 1–233	Nearest WRS-2 path to the Line-of-Sight (LOS) scene center of the image.
TARGET_WRS_ROW	= 1–248, 880–889, 990–999	Nearest WRS-2 row to the LOS scene center of the image. Rows 880–889 and 990–999 are reserved for the polar regions where it is undefined in the WRS-2.
DATE_ACQUIRED	= YYYY-MM-DD	The date the image was acquired.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SCENE_CENTER_TIME	= “HH:MI:SS.SSSSSSSZ”	Scene center time of the date the image was acquired. HH = Hour (00-23), MI = Minute, SS.SSSSSSS = Fractional seconds, Z = constant (indicates “Zulu” time (same as GMT)).
CORNER_UL_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the upper-left corner of the product, measured at the center of the pixel. Positive (+) value indicates north latitude; negative (-) value indicates south latitude. Units are in degrees.
CORNER_UL_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the upper-left corner of the product, measured at the center of the pixel. Positive (+) value indicates east longitude; negative (-) value indicates west longitude. Units are in degrees.
CORNER_UR_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the upper-right corner of the product. Measured at the center of the pixel. Units are in degrees.
CORNER_UR_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the upper-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LL_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the lower-left corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LL_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the lower-left corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LR_LAT_PRODUCT	= -90.00000 through +90.00000	The latitude value for the lower-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_LR_LON_PRODUCT	= -180.00000 through +180.00000	The longitude value for the lower-right corner of the product, measured at the center of the pixel. Units are in degrees.
CORNER_UL_PROJECTION_X_ PRODUCT	= -132000000.000 through 132000000.000	The upper-left corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_UL_PROJECTION_Y_ PRODUCT	= -132000000.000 through 132000000.000	The upper-left corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
CORNER_UR_PROJECTION_X_ PRODUCT	= -132000000.000 through 132000000.000	The upper-right corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_UR_PROJECTION_Y_ PRODUCT	= -132000000.000 through 132000000.000	The upper-right corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LL_PROJECTION_X_P RODUCT	= -132000000.000 through 132000000.000	The lower-left corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LL_PROJECTION_Y_P RODUCT	= -132000000.000 through 132000000.000	The lower-left corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LR_PROJECTION_X_ PRODUCT	= -132000000.000 through 132000000.000	The lower-right corner map projection X coordinate, measured at the center of the pixel. Units are in meters.
CORNER_LR_PROJECTION_Y_ PRODUCT	= -132000000.000 through 132000000.000	The lower-right corner map projection Y coordinate, measured at the center of the pixel. Units are in meters.
PANCHROMATIC_LINES	= 0–99999	The number of product lines for the panchromatic band (Band 8). This parameter is only present if the panchromatic band is present in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
PANCHROMATIC_SAMPLES	= 0–99999	The number of product samples for the panchromatic band (Band 8). This parameter is only present if the panchromatic band is in the product.
REFLECTIVE_LINES	= 0–99999	The number of product lines for the reflective bands (Bands 1–7 and Band 9). This parameter is only present if reflective bands are in the product.
REFLECTIVE_SAMPLES	= 0–99999	The number of product samples for the reflective bands (Bands 1–7 and Band 9). This parameter is only present if reflective bands are in the product.
THERMAL_LINES	= 0–99999	The number of product lines for the thermal bands (Bands 10–11). This parameter is only present if thermal bands are in the product.
THERMAL_SAMPLES	= 0–99999	The number of product samples for the thermal bands (Bands 10–11). This parameter is only present if thermal bands are in the product.
FILE_NAME_BAND_1	= “Ls8ppprrrYYYYDDDGGGVV_B1.TIF”	The file name for Band 1. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_2	= “Ls8ppprrrYYYYDDDGGGVV_B2.TIF”	The file name for Band 2. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_3	= “Ls8ppprrrYYYYDDDGGGVV_B3.TIF”	The file name for Band 3. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_4	= “Ls8ppprrrYYYYDDDGGGVV_B4.TIF”	The file name for Band 4. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_5	= “Ls8ppprrrYYYYDDDGGGVV_B5.TIF”	The file name for Band 5. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_6	= “Ls8ppprrrYYYYDDDGGGVV_B6.TIF”	The file name for Band 6. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_7	= “Ls8ppprrrYYYYDDDGGGVV_B7.TIF”	The file name for Band 7. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_8	= “Ls8ppprrrYYYYDDDGGGVV_B8.TIF”	The file name for Band 8. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_9	= “Ls8ppprrrYYYYDDDGGGVV_B9.TIF”	The file name for Band 9. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_10	= “Ls8ppprrrYYYYDDDGGGVV_B10.TIF”	The file name for Band 10. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_11	= “Ls8ppprrrYYYYDDDGGGVV_B11.TIF”	The file name for Band 11. This parameter is only present if the band is included in the product.
FILE_NAME_BAND_QUALITY	= “Ls8ppprrrYYYYDDDGGGVV_BQA.TIF”	The file name for the QB. This parameter is only present if the band is included in the product.
METADATA_FILE_NAME	= “Ls8ppprrrYYYYDDDGGGVV_MTL.txt”	The file name for L1 metadata.
ANGLE_COEFFICIENT_FILE_NAME	= “Ls8ppprrrYYYYDDDGGGVV_ANG.txt”	The file name for the angle coefficient file. This parameter is only present if the angle coefficient file is included in the product.
BPF_NAME_OLI	= “LO8BPFYYYY$_1$MM$_1$DD$_1$hh$_1$mm$_1$ss$_1$_YYYY$_2$MM$_2$DD$_2$hh$_2$mm$_2$ss$_2$.nn”	The file name for the Bias Parameter File (BPF) used to generate the product, if applicable. This only applies to products that contain OLI bands.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
BPF_NAME_TIRS	= "LT8BPFYYYY$_1$MM$_1$DD$_1$hh$_1$mm$_1$ss$_1$_YYYY$_2$MM$_2$DD$_2$hh$_2$mm$_2$ss$_2$.nn"	The file name for the BPF used to generate the product, if applicable. This only applies to products that contain TIRS bands.
CPF_NAME	= "L8CPFyyyy$_1$mm$_1$dd$_1$_yyyy$_2$mm$_2$dd$_2$.nn"	The file name for the Calibration Parameter File (CPF) used to generate the product.
RLUT_FILE_NAME	= "L8RLUTyyyymm$_1$dd$_1$_yyyy$_2$mm$_2$dd$_2$Vnn.h5"	The file name for the Response Linearization Lookup Table (RLUT) used to generate the product, if applicable.
END_GROUP	= PRODUCT_METADATA	The end of the product metadata group.
GROUP	= IMAGE_ATTRIBUTES	The beginning of the image attributes group.
CLOUD_COVER	= 0.00–100.00, -1	The overall cloud coverage (percent) of the WRS-2 scene. -1 indicates that the score was not calculated.
CLOUD_COVER_LAND	= 0.00–100.00, -1	The overall cloud coverage over land (percent) in the WRS-2 scene. -1 indicates that the score was not calculated.
IMAGE_QUALITY_OLI	= 0–9	The composite image quality for the OLI bands. Values: 9 = Best. 1 = Worst. 0 = Image quality not calculated. This parameter is only present if OLI bands are present in the product.
IMAGE_QUALITY_TIRS	= 0–9	The composite image quality for the TIRS bands. Values: 9 = Best. 1 = Worst. 0 = Image quality not calculated. This parameter is only present if TIRS bands are present in the product.
TIRS_SSM_POSITION_STATUS	= "NOMINAL" = "ESTIMATED" = "DEFAULT" = "SWITCHED"	The TIRS scene select mirror position status. The "NOMINAL" status indicates the SSM was functioning normally for this scene. The "SWITCHED" status indicates the SSM switched operating modes in the scene and may have TIRS image quality issues. The "ESTIMATED" status indicates SSM position was estimated, which may not be as accurate as the "NOMINAL" status. The "DEFAULT" status indicates the SSM position data was missing and default NADIR position is assumed.
ROLL_ANGLE	= -15.00 through +15.00	The amount of spacecraft roll angle at the scene center. The roll value is given in the Yaw Steering Frame (YSF) reference, whose x-axis is aligned with the instantaneous ground track velocity vector. Rolls about this x-axis go by the right-hand rule: a positive roll results in the instruments pointing to the left of the ground track, while a negative roll results in the instrument pointing to the right.
SUN_AZIMUTH	= -180.00000000 through 180.00000000	The Sun azimuth angle in degrees for the image center location at the image center acquisition time. A positive value indicates angles to the east or clockwise from the north. A negative value (-) indicates angles to the west or counterclockwise from the north.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SUN_ELEVATION	= -90.00000000 through 90.00000000	The Sun elevation angle in degrees for the image center location at the image center acquisition time. A positive value indicates a daytime scene. A negative value (-) indicates a nighttime scene. Note: For reflectance calculation, the sun zenith angle is needed, which is 90 - sun elevation angle.
EARTH_SUN_DISTANCE	= N.NNNNNNN	Measurement of the earth to sun distance at the particular day and time of imagery acquisition. Astronomical Unit (AU) of measurement.
GROUND_CONTROL_POINTS_VERSION	= 0-999	GCP dataset version used in the precision correction process. This parameter is only present if the DATA_TYPE is L1T.
GROUND_CONTROL_POINTS_MODEL	= 1-999	Number of GCPs used in the precision correction process. This parameter is only present if the DATA_TYPE is L1T.
GEOMETRIC_RMSE_MODEL	= N.NNN	Combined Root Mean Squared Error (RMSE) of the geometric residuals (meters) in both across-track and along-track directions measured on the GCPs used in geometric precision correction. This parameter is only present if the DATA_TYPE is L1T.
GEOMETRIC_RMSE_MODEL_Y	= N.NNN	The post-fit RMSE for the along-track direction. Units are in meters equal to or greater than zero, with no upper limit, and three decimal places. This parameter is only present if the DATA_TYPE is L1T.
GEOMETRIC_RMSE_MODEL_X	= N.NNN	The post-fit RMSE for the along-track direction. Units are in meters equal to or greater than zero, with no upper limit, and three decimal places. This parameter is only present if the DATA_TYPE is L1T.
GROUND_CONTROL_POINTS_VERIFY	=1-9999	Number of GCPs used in the verification of the terrain corrected product. This parameter is only present if it was calculated.
GEOMETRIC_RMSE_VERIFY	=0.000-9999.999	RMSE of the geometric residuals (meters) measured on the terrain-corrected product independently using GLS2000. This parameter is only present if it was calculated.
END_GROUP	= IMAGE_ATTRIBUTES	The end of the image attributes group.
GROUP	= MIN_MAX_RADIANCE	
RADIANCE_MAXIMUM_BAND_1	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 1. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_1	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 1. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_2	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 2. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_2	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 2. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_3	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 3. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MINIMUM_BAND_3	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 3. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_4	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 4. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_4	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 4. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_5	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 5. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_5	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 5. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_6	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 6. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_6	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 6. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_7	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 7. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_7	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 7. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_8	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 8. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_8	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 8. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_9	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 9. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_9	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 9. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_10	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 10. This parameter is only present if this band is included in the product.
RADIANCE_MINIMUM_BAND_10	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 10. This parameter is only present if this band is included in the product.
RADIANCE_MAXIMUM_BAND_11	= NNN.NNNNN	Maximum achievable spectral radiance value for Band 11. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_MINIMUM_BAND_11	= NNN.NNNNN	Minimum achievable spectral radiance value for Band 11. This parameter is only present if this band is included in the product.
END_GROUP	= MIN_MAX_RADIANCE	
GROUP	= MIN_MAX_REFLECTANCE	Minimum and maximum reflectance values for the OLI bands. This group is only present if there are OLI bands present in the product.
REFLECTANCE_MAXIMUM_BAND_1	= N.NNNNNN	Maximum achievable reflectance value for Band 1. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_1	= N.NNNNNN	Minimum achievable reflectance value for Band 1. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_2	= N.NNNNNN	Maximum achievable reflectance value for Band 2. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_2	= N.NNNNNN	Minimum achievable reflectance value for Band 2. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_3	= N.NNNNNN	Maximum achievable reflectance value for Band 3. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_3	= N.NNNNNN	Minimum achievable reflectance value for Band 3. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_4	= N.NNNNNN	Maximum achievable reflectance value for Band 4. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_4	= N.NNNNNN	Minimum achievable reflectance value for Band 4. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_5	= N.NNNNNN	Maximum achievable reflectance value for Band 5. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_5	= N.NNNNNN	Minimum achievable reflectance value for Band 5. This parameter is not present if this band is not included in the product.
REFLECTANCE_MAXIMUM_BAND_6	= N.NNNNNN	Maximum achievable reflectance value for Band 6. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_6	= N.NNNNNN	Minimum achievable reflectance value for Band 6. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_7	= N.NNNNNN	Maximum achievable reflectance value for Band 7. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_7	= N.NNNNNN	Minimum achievable reflectance value for Band 7. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_8	= N.NNNNNN	Maximum achievable reflectance value for Band 8. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_8	= N.NNNNNN	Minimum achievable reflectance value for Band 8. This parameter is only present if this band is included in the product.
REFLECTANCE_MAXIMUM_BAND_9	= N.NNNNNN	Maximum achievable reflectance value for Band 9. This parameter is only present if this band is included in the product.
REFLECTANCE_MINIMUM_BAND_9	= N.NNNNNN	Minimum achievable reflectance value for Band 9. This parameter is only present if this band is included in the product.
END_GROUP	= MIN_MAX_REFLECTANCE	
GROUP	= MIN_MAX_PIXEL_VALUE	

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MAX_BAND_1	= 1-65535	Maximum possible pixel value for Band 1. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_1	= 0-1	Minimum possible pixel value for Band 1. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_2	= 1-65535	Maximum possible pixel value for Band 2. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_2	= 0-1	Minimum possible pixel value for Band 2. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_3	= 1-65535	Maximum possible pixel value for Band 3. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_3	= 0-1	Minimum possible pixel value for Band 3. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_4	= 1-65535	Maximum possible pixel value for Band 4. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_4	= 0-1	Minimum possible pixel value for Band 4. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_5	= 1-65535	Maximum possible pixel value for Band 5. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_5	= 0-1	Minimum possible pixel value for Band 5. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_6	= 1-65535	Maximum possible pixel value for Band 6. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_6	= 0-1	Minimum possible pixel value for Band 6. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_7	= 1-65535	Maximum possible pixel value for Band 7. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_7	= 0-1	Minimum possible pixel value for Band 7. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_8	= 1-65535	Maximum possible pixel value for Band 8. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_8	= 0-1	Minimum possible pixel value for Band 8. This parameter is only present if this band is included in the product
QUANTIZE_CAL_MAX_BAND_9	= 1-65535	Maximum possible pixel value for Band 9. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_9	= 0-1	Minimum possible pixel value for Band 9. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_10	= 1-65535	Maximum possible pixel value for Band 10. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MIN_BAND_10	= 0-1	Minimum possible pixel value for Band 10. This parameter is only present if this band is included in the product.
QUANTIZE_CAL_MAX_BAND_11	= 1-65535	Maximum possible pixel value for Band 11. This parameter is only present if this band is included in the product.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
QUANTIZE_CAL_MIN_BAND_11	= 0-1	Minimum possible pixel value for Band 11. This parameter is only present if this band is included in the product.
END_GROUP	= MIN_MAX_PIXEL_VALUE	
GROUP	= RADIOMETRIC_RESCALING	The beginning of the radiometric rescaling group. The parameter for a band is only included if that band is present in the product.
RADIANCE_MULT_BAND_1	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 1 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_2	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 2 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_3	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 3 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_4	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 4 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_5	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 5 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_6	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 6 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_7	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 7 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_8	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 8 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_9	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 9 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_10	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 10 (W/(m^2 sr um)/DN).
RADIANCE_MULT_BAND_11	= N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Radiance units for Band 11 (W/(m^2 sr um)/DN).
RADIANCE_ADD_BAND_1	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 1 (W/(m^2 sr um)).
RADIANCE_ADD_BAND_2	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 2 (W/(m^2 sr um).
RADIANCE_ADD_BAND_3	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 3 (W/(m^2 sr um).
RADIANCE_ADD_BAND_4	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 4 (W/(m^2 sr um).
RADIANCE_ADD_BAND_5	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 5 (W/(m^2 sr um).
RADIANCE_ADD_BAND_6	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 6 (W/(m^2 sr um).
RADIANCE_ADD_BAND_7	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 7 (W/(m^2 sr um).
RADIANCE_ADD_BAND_8	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 8 (W/(m^2 sr um).

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
RADIANCE_ADD_BAND_9	= NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 9 (W/(m^2 sr um).
RADIANCE_ADD_BAND_10	=NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 10 (W/(m^2 sr um).
RADIANCE_ADD_BAND_11	=NN.NNNNN	The additive rescaling factor used to convert calibrated DN to Radiance units for Band 11 (W/(m^2 sr um).
REFLECTANCE_MULT_BAND_1	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 1 (DN^{-1}).
REFLECTANCE_MULT_BAND_2	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 2 (DN^{-1}).
REFLECTANCE_MULT_BAND_3	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 3 (DN^{-1}).
REFLECTANCE_MULT_BAND_4	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 4 (DN^{-1}).
REFLECTANCE_MULT_BAND_5	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 5 (DN^{-1}).
REFLECTANCE_MULT_BAND_6	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 6 (DN^{-1}).
REFLECTANCE_MULT_BAND_7	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 7 (DN^{-1}).
REFLECTANCE_MULT_BAND_8	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 8 (DN^{-1}).
REFLECTANCE_MULT_BAND_9	=N.NNNNeNN	The multiplicative rescaling factor used to convert calibrated DN to Reflectance for Band 9 (DN^{-1}).
REFLECTANCE_ADD_BAND_1	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 1.
REFLECTANCE_ADD_BAND_2	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 2.
REFLECTANCE_ADD_BAND_3	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 3.
REFLECTANCE_ADD_BAND_4	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 4.
REFLECTANCE_ADD_BAND_5	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 5.
REFLECTANCE_ADD_BAND_6	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 6.
REFLECTANCE_ADD_BAND_7	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 7.
REFLECTANCE_ADD_BAND_8	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 8.
REFLECTANCE_ADD_BAND_9	=N.NNNNNN	The additive rescaling factor used to convert calibrated DN to Reflectance for Band 9.
END_GROUP	= RADIOMETRIC_RESCALING	The end of the radiometric rescaling group.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= TIRS_THERMAL_CONSTANTS	The beginning of the TIRS thermal constants group. This group is included only with products that include TIRS data. Note: Temperature in degrees Kelvin = K2/(ln(K1/Radiance + 1)).
K1_CONSTANT_BAND_10	= N.NNNN	K1 coefficient for Band 10 radiance to temperature conversion.
K1_CONSTANT_BAND_11	= N.NNNN	K1 coefficient for Band 11 radiance to temperature conversion.
K2_CONSTANT_BAND_10	= N.NNNN	K2 coefficient for Band 10 radiance to temperature conversion.
K2_CONSTANT_BAND_11	= N.NNNN	K2 coefficient for Band 11 radiance to temperature conversion.
END_GROUP	= TIRS_THERMAL_CONSTANTS	The end of TIRS thermal constants group.
GROUP	= PROJECTION_PARAMETERS	The beginning of the projection parameters group.
MAP_PROJECTION	= “UTM” = “PS”	The map projection used in creating the image. Universal Transverse Mercator (UTM) or Polar Stereographic (PS).
DATUM	= “WGS84”	The datum used in creating the image.
ELLIPSOID	= “WGS84”	The ellipsoid used in creating the image.
UTM_ZONE	= 1 to 60	The value used to indicate the zone number. This parameter is only included for the UTM projection.
VERTICAL_LON_FROM_POLE	= 0.00000	The vertical longitude from the pole. This parameter is only included for the polar stereographic projection.
TRUE_SCALE_LAT	= -71.00000 = 71.00000	The latitude of true scale. A value of -71 is used for scenes over Antarctica and 71 is used for off-nadir scenes at the North Pole. This parameter is only included for the polar stereographic projection.
FALSE_EASTING	= 0	False easting in meters. This parameter is only included for the polar stereographic projection.
FALSE_NORTHING	= 0	False northing in meters. This parameter is only included for the polar stereographic projection.
GRID_CELL_SIZE_PANCHROMATIC	= 15.00	The grid cell size in meters used in creating the image for the panchromatic band, if part of the product. This parameter is only included if the panchromatic band is included in the product.
GRID_CELL_SIZE_REFLECTIVE	= 30.00	The grid cell size in meters used in creating the image for Visible and Near Infrared (VNIR) / Short-Wave Infrared (SWIR) bands, if part of the product. This parameter is only included if the reflective bands are included in the product.
GRID_CELL_SIZE_THERMAL	= 30.00	The grid cell size in meters used in creating the image for the thermal bands, if part of the product. This parameter is only included if the thermal bands are included in the product.
ORIENTATION	= “NORTH_UP” = “NOMINAL”	The orientation used in creating the image.
RESAMPLING_OPTION	= “CUBIC_CONVOLUTION”	The resampling option used in creating the image. Cubic Convolution (CC).
END_GROUP	= PROJECTION_PARAMETERS	The end of the projection parameters group.
END_GROUP	= L1_METADATA_FILE	The end of the L1 metadata file level group.
END		Required standalone parameter signifying the file end.

Table 3-4. L1Gt / L1T Metadata File

3.1.5 L1 Angle Coefficients File

The L1 angle coefficients file can be created during product generation and contains metadata and coefficients that allow solar and satellite viewing angles to be calculated.
Table 3-5. Angle Coefficients File

lists the full contents of the L1 angle coefficients file. The angle coefficients file is text in the ODL format. Refer to http://landsat.usgs.gov for information on using the L1 angle coefficient file.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
GROUP	= FILE_HEADER	The beginning of the file header ODL group.
LANDSAT_SCENE_ID	= “Ls8ppprrrYYYYDDDGGGVV”	The unique Landsat scene identifier.
SPACECRAFT_ID	= “LANDSAT_8”	Spacecraft from which the data were captured.
NUMBER_OF_BANDS	= 1 – 11	Number of bands contained in the angle coefficient file.
BAND_LIST	= (1,2,3,4,5,6,7,8,9,10,11)	List of spectral bands contained in the angle coefficient file. The number of bands listed is specified by the NUMBER_OF_BANDS parameter.
END_GROUP	= FILE_HEADER	The end of the file header ODL group.
GROUP	= PROJECTION	The beginning of the projection ODL group.
ELLIPSOID_AXES	= (Semi-major, Semi-minor)	WGS84 ellipsoid semi-major and semi-minor axes in meters.
MAP_PROJECTION	= “UTM“ = “PS“	The map projection used in creating the image. UTM or PS.
PROJECTION_UNITS	= “METERS”	Map projection units, which are always METERS.
DATUM	= “WGS84”	The datum used in creating the image.
ELLIPSOID	= “WGS84”	The ellipsoid used in creating the image.
UTM_ZONE	= 1 – 60	UTM zone number (1 – 60). Field is absent for non-UTM projections.
PROJECTION_PARAMETERS	= (P_1 … P_{15})	GCTP map projection parameters array with 15 double precision floating point parameters. This is all zeros for UTM. Polar stereographic includes ellipsoid axes, false easting and northing (both 0), latitude of true scale (+/- 71) and the vertical axis longitude (also 0).
UL_CORNER	= (X, Y)	L1T upper-left corner map projection coordinates in meters (doubles).
UR_CORNER	= (X, Y)	L1T upper-right corner map projection coordinates in meters (doubles).
LL_CORNER	= (X, Y)	L1T lower-left corner map projection coordinates in meters (doubles).
LR_CORNER	= (X, Y)	L1T lower-right corner map projection coordinates in meters (doubles).
END_GROUP	= PROJECTION	The end of the projection ODL group.
GROUP	= EPHEMERIS	The beginning of the ephemeris ODL group.
EPHEMERIS_EPOCH_YEAR	= YYYY	Year of ephemeris starting time epoch (integer).
EPHEMERIS_EPOCH_DAY	= DDD	Day of year of ephemeris epoch (integer).
EPHEMERIS_EPOCH_SECONDS	= Seconds	Seconds of day of ephemeris epoch (double)
NUMBER_OF_POINTS	= 1 – 99999	Number of ephemeris points contained in the next four parameter fields.
EPHEMERIS_TIME	= ($time_1$ … $time_N$)	Array of double precision ephemeris sample time offsets (from epoch) in seconds.
EPHEMERIS_ECEF_X	= (X_1 … X_N)	Array of double precision ephemeris samples Earth Centered Earth Fixed (ECEF) X coordinates in meters.
EPHEMERIS_ECEF_Y	= (Y_1 … Y_N)	Array of double precision ephemeris samples ECEF Y coordinates in meters.
EPHEMERIS_ECEF_Z	= (Z_1 … Z_N)	Array of double precision ephemeris samples ECEF Z coordinates in meters.
END_GROUP	= EPHEMERIS	The end of the ephemeris ODL group.
GROUP	= SOLAR_VECTOR	The beginning of the solar vector ODL group.
SOLAR_EPOCH_YEAR	= YYYY	Year of solar start time (integer).
SOLAR_EPOCH_DAY	= DDD	Day of year of solar start time (integer).

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
SOLAR_EPOCH_SECONDS	= Seconds	Seconds of day of solar start time (double).
EARTH_SUN_DISTANCE	= Distance	Measurement of the earth to sun distance at the particular day and time of imagery acquisition. Astronomical Unit (AU) of measurement.
NUMBER_OF_POINTS	= 1 – 99999	Number of solar vector points contained in the next four parameter fields.
SAMPLE_TIME	= ($time_1$ … $time_N$)	Array of double precision solar vector sample time offsets (from epoch) in seconds.
SOLAR_ECEF_X	= (X_1 … X_N)	Array of double precision solar vector samples ECEF X direction.
SOLAR_ECEF_Y	= (Y_1 … Y_N)	Array of double precision solar vector samples ECEF Y direction.
SOLAR_ECEF_Z	= (Z_1 … Z_N)	Array of double precision solar vector samples ECEF Z direction.
END_GROUP	= SOLAR_VECTOR	The end of the solar vector ODL group.
GROUP	= RPC_BAND##	The beginning of the Rational Polynomial Coefficients (RPC) Band ## ODL group. The "##" corresponds to the band number (1 – 11). This group is repeated for every band that is present.
BAND##_NUMBER_OF_SCAS	= 1 – 14	Number of SCAs present in the coefficient file.
BAND##_NUM_L1T_LINES	= 1 – 99999	Number of lines in the L1T product.
BAND##_NUM_L1T_SAMPS	= 1 – 99999	Number of samples in the L1T product.
BAND##_L1T_IMAGE_CORNER_LINES	= (Upper Left, Upper Right, Lower Left, Lower Right)	Defines the image corner line coordinates in the L1T image (as doubles).
BAND##_L1T_IMAGE_CORNER_SAMPS	= (Upper Left, Upper Right, Lower Left, Lower Right)	Defines the image corner sample coordinates in the L1T image (as doubles).
BAND##_NUM_L1R_LINES	= 1 – 99999	Number of lines in the L1R product.
BAND##_NUM_L1R_SAMPS	= 1 – 99999	Number of samples in the L1R product.
BAND##_PIXEL_SIZE	= L1T pixel size	L1T pixel size in meters.
BAND##_START_TIME	= Start Time	L1R image start time in seconds from the ephemeris epoch.
BAND##_LINE_TIME	= Seconds per line	L1R image line time increment in seconds.
BAND##_MEAN_HEIGHT	= Mean Height	Mean height offset over the scene for the RPC angle model (double).
BAND##_MEAN_L1R_LINE_SAMP	= (Line, Sample)	Mean L1R line and sample offsets for the RPC angle model (doubles).
BAND##_MEAN_L1T_LINE_SAMP	= (Line, Sample)	Mean L1T line and sample offsets for the RPC angle model (doubles).
BAND##_MEAN_SAT_VECTOR	= (X, Y, Z)	Mean satellite view vector for the RPC angle model (doubles).
BAND##_SAT_X_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector X coordinate.
BAND##_SAT_X_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector X coordinate.
BAND##_SAT_Y_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector Y coordinates.
BAND##_SAT_Y_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector Y coordinate.
BAND##_SAT_Z_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the satellite view vector Z coordinates.

Parameter Name	Value, Format, and Range	Parameter Description / Remarks
BAND##_SAT_Z_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the satellite view vector Z coordinate.
BAND##_MEAN_SUN_VECTOR	= (X, Y, Z)	Mean sun vector for the RPC angle model (doubles).
BAND##_SUN_X_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector X coordinate.
BAND##_SUN_X_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of denominator polynomial coefficients for the sun vector X coordinate.
BAND##_SUN_Y_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector Y coordinates.
BAND##_SUN_Y_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the sun vector Y coordinates.
BAND##_SUN_Z_NUM_COEF	= (a_0 … a_9)	Array (ten elements) of double precision numerator polynomial coefficients for the sun vector Z coordinates.
BAND##_SUN_Z_DEN_COEF	= (b_1 ... b_9)	Array (nine elements) of double precision denominator polynomial coefficients for the sun vector Z coordinates.
BAND##_SCA_LIST	= (1,2,3,4,5,6,7,8,9,10,11,12,13,14)	List of SCAs in this band. OLI normally has 14 and TIRS normally has 3.
BAND##_SCA##_MEAN_HEIGHT	= Mean Height	Mean height offset for the SCA## L1T to L1R RPC model. The "**##**" behind the SCA denotes the SCA number. This field and the following six fields are repeated for each SCA present in the SCA list for the current band and for each following band.
BAND##_SCA##_MEAN_L1R_LINE_SAMP	= (Line, Sample)	Mean L1R line and sample offsets for the SCA## L1T to L1R RPC model (doubles).
BAND##_SCA##_MEAN_L1T_LINE_SAMP	= (Line, Sample)	Mean L1T line and sample offsets for the SCA## L1T to L1R RPC model (doubles).
BAND##_SCA##_LINE_NUM_COEF	= (a_0 … a_4)	Array (five elements) of numerator polynomial coefficients for the SCA## L1R line RPC model (doubles).
BAND##_SCA##_LINE_DEN_COEF	= (b_1 … b_4)	Array (four elements) of denominator polynomial coefficients for the SCA## L1R line RPC model (doubles).
BAND##_SCA##_SAMP_NUM_COEF	= (c_0 … c_4)	Array (five elements) of numerator polynomial coefficients for the SCA## L1R sample RPC model (doubles).
BAND##_SCA##_SAMP_DEN_COEF	= (d_1 … d_4)	Array (four elements) of denominator polynomial coefficients for the SCA## L1R sample RPC model (doubles).
END_GROUP	= RPC_BAND##	The end of the RPC BAND ## ODL group. This group is followed by the next RPC_BAND## ODL group (if present).

Table 3-5. Angle Coefficients File

References

Please see http://landsat.usgs.gov/tools_acronyms_ALL.php for a list of acronyms.

EPSG Geodetic Parameter Registry. Version 7.4. <http://www.epsg-registry.org>.

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USGS/EROS. LSDS-293. Landsat Data Management Policy.

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